

## Climate Dynamics (PCC 587): An Introduction to the Course



DARGAN M. W. FRIERSON  
UNIVERSITY OF WASHINGTON, DEPARTMENT  
OF ATMOSPHERIC SCIENCES

DAY 1: 10-1-09

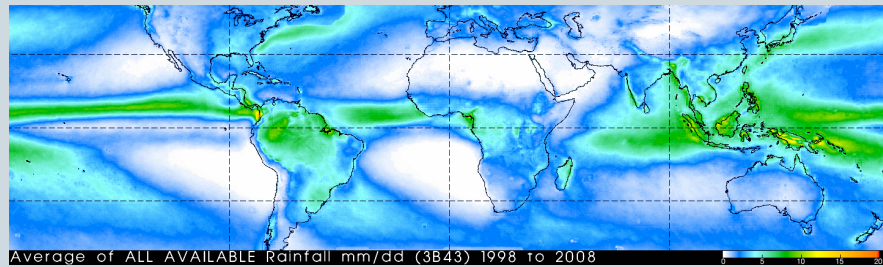
## Susan Solomon Talk Today!



- Discovered ozone hole link with CFCs
- Chair of IPCC Working Group 1
- 3:30 PM, Johnson 102
- “A Tale for Our Times: Climate Change and Irreversibility”

## Climate Dynamics

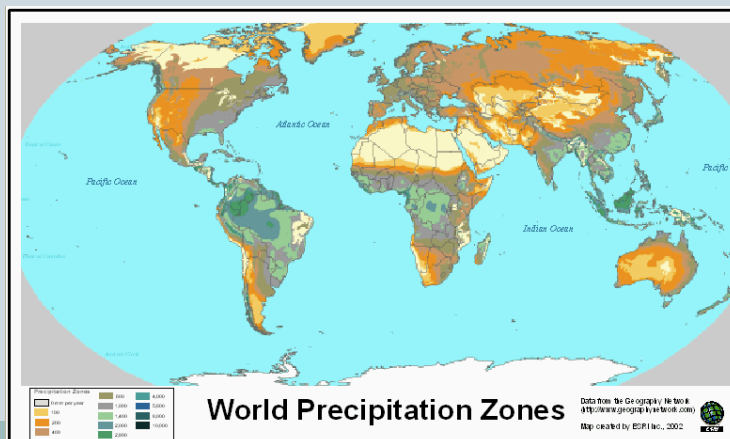
- Questions like:
  - What determines the current climate mean state?
  - Mean precipitation distribution:



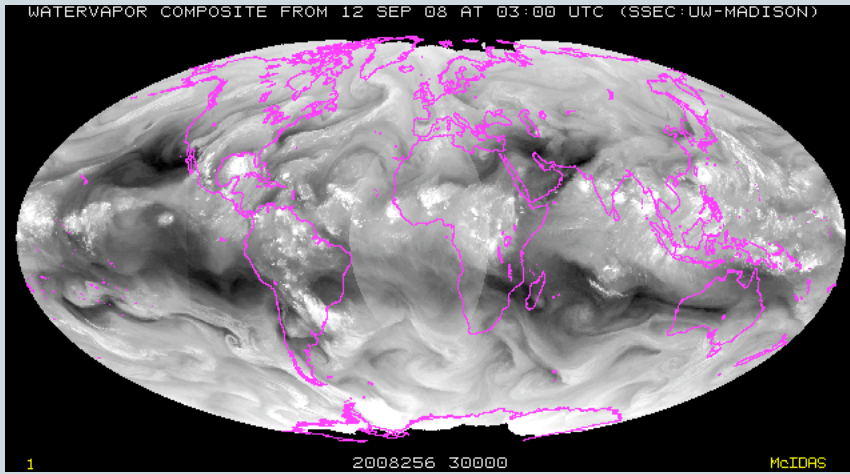
TRMM Climatology (1998-2008)

## Questions like...

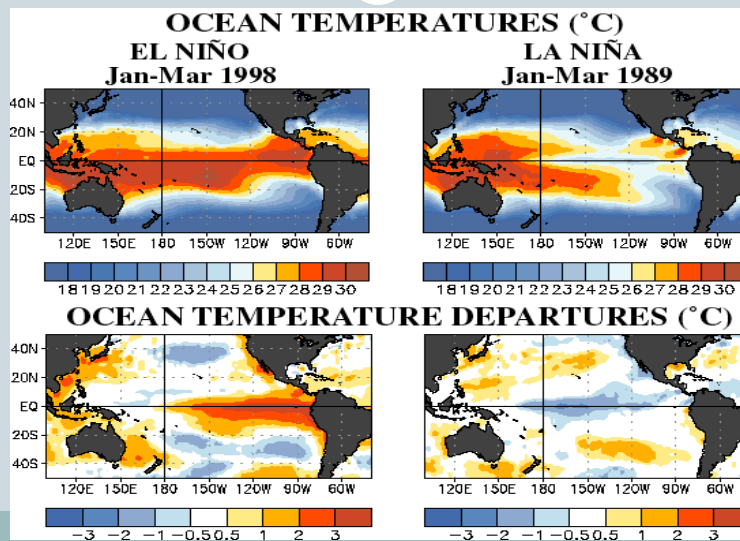
- Why are the rainforests and deserts of the world at similar latitudes?



## Current Climate

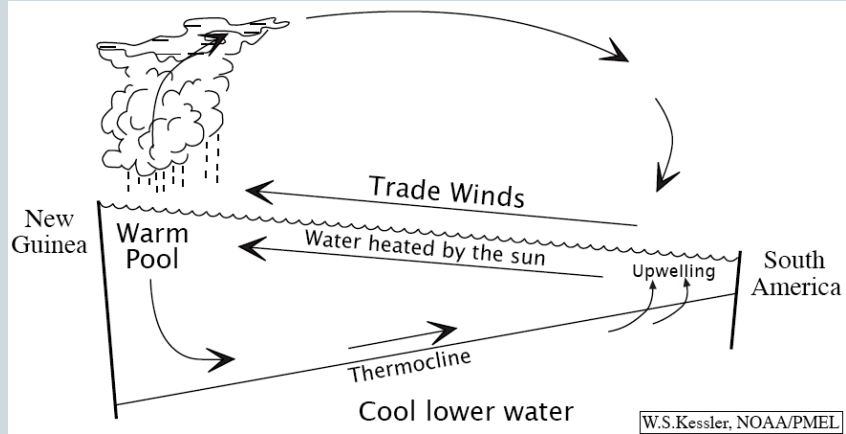


## Natural Climate Variability: El Niño



## El Niño/Southern Oscillation

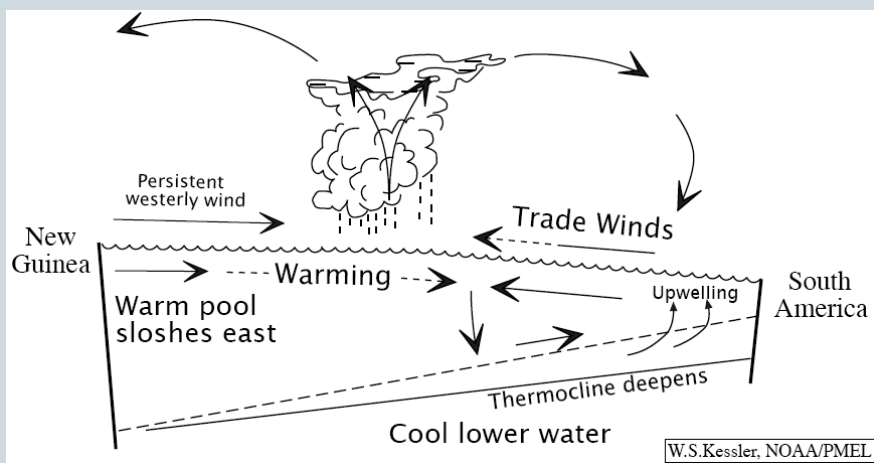
### La Niña conditions



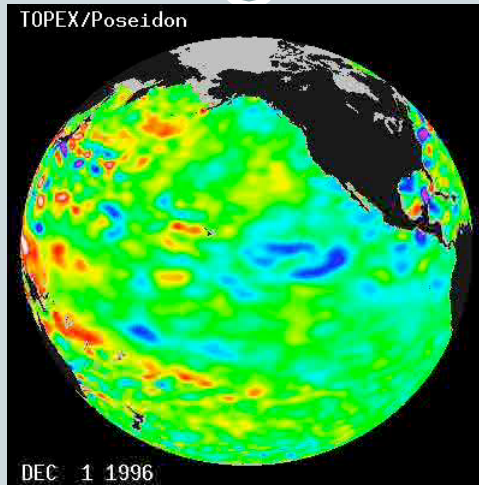
**Winds keep warm water to the west during La Niña**

## El Niño/Southern Oscillation

### El Niño conditions

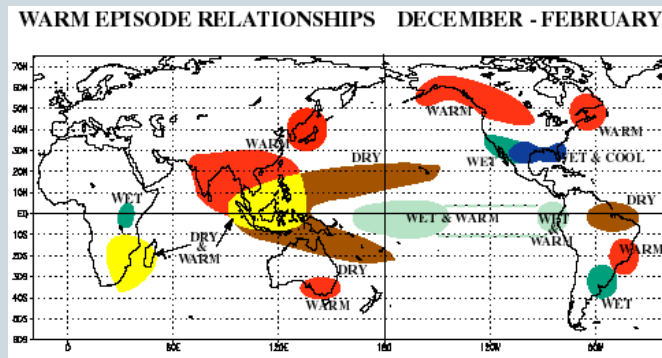


## El Niño/Southern Oscillation



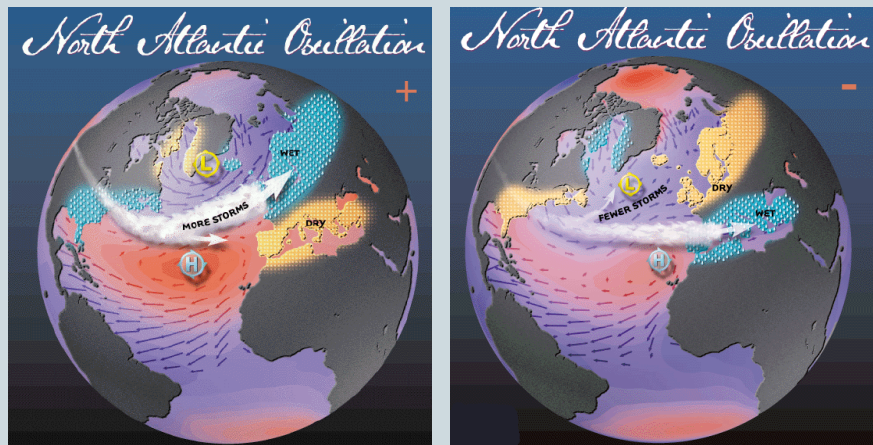
## El Niño/Southern Oscillation

- Impacts are global:



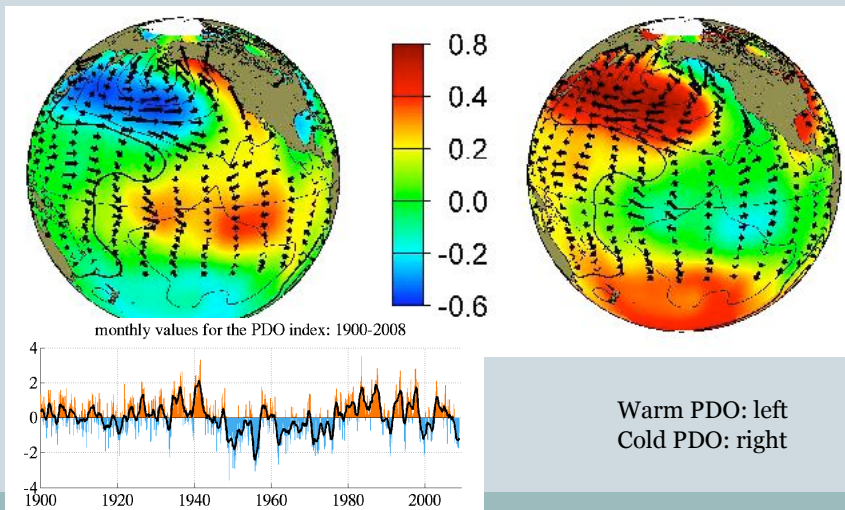
## North Atlantic Oscillation

- Shifts of storm tracks in the Atlantic



Arctic Oscillation: a similar phenomenon all the way around the N. Hemisphere

## Pacific Decadal Oscillation



Warm PDO: left  
Cold PDO: right

## PDO Impacts

- PDO impacts on salmon catches ->
- PDO tells you whether they're biting in Alaska or Washington

From Mantua et al (1997)

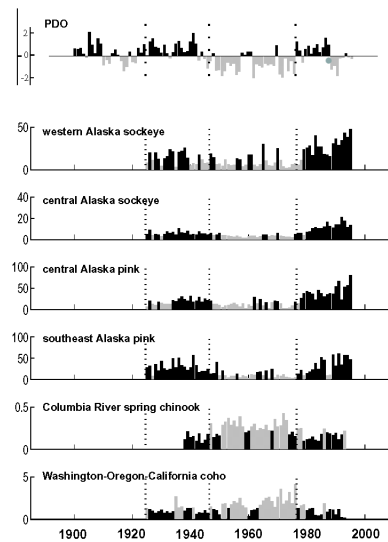
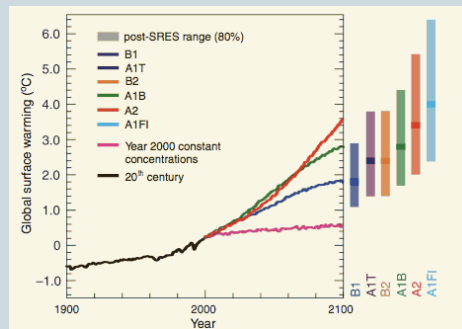


Figure 6: Selected Pacific salmon catch records with PDO signatures. For Alaska catches, black (grey) bars denote values that are greater than the long-term median. The shading convention is reversed for WOC coho and Columbia River spring chinook. Light, dotted vertical lines are drawn to mark the PDO reversal times at 1925, 1947, and 1977. The PDO index from Figure 1 is repeated in the top panel.

## Climate Change

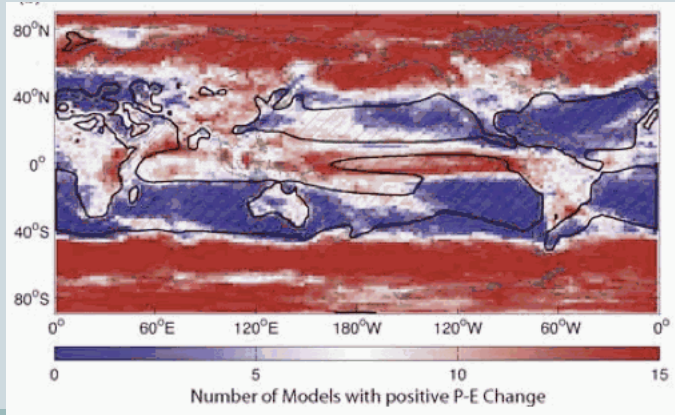
- We're modifying the atmospheric composition and climate at a rapid rate
- How much warming?
  - Depends on feedbacks:
    - ✦ Water vapor
    - ✦ Ice-albedo (melting ice reflects less solar radiation)
    - ✦ Clouds
- We'll discuss a framework for feedback analysis, and these individual processes





## Climate Change

- What to expect?
  - Rainy gets rainier, dry gets drier



From Lu et al 2006

## Paleoclimate

- Ice Age cycles
  - Last Glacial Maximum (21,000 years ago)
- Extreme climates of long ago?
  - “Snowball Earth”

